AMENDMENTS TO THE SPECIFICATION:

Please amend the paragraph beginning at page 1, line 17, as follows:

~~Prior Art~~

BACKGROUND

Users of portable battery-powered communication devices are dependent of a fully functional device. More specifically, the users need to know exactly for how long their devices will remain functional, until the electric energy stored in the battery has been consumed and the battery has to be recharged. This is particularly true for users of mobile telephones. Hence, for the rest of this document a mobile telephone is used, in a non-limiting sense, for exemplifying the inventive portable communication device and method.

Please amend the paragraph beginning at page 2, line 5, as follows:

Determining the remaining battery capacity basically includes two separate current measurements: one measurement for the current flowing into the battery (charging) and one measurement for the current consumed from the battery (discharging).

Please amend the paragraph beginning at page 2, line 10, as follows:

The charging current is often relatively easy to measure. A microprocessor (CPU) may read an A/D-converted signal, which is directly proportional to the current flowing through a small resistor. Since the microprocessor controls the charging process, it will also have access to all relevant data for calculating the total current, that has been supplied to the battery during a certain period of time.

Please amend the paragraph at page 2, line 18 as follows:

Measuring the discharge current or current consumption, on the other hand, is much more difficult, particularly for advanced telephones with complex functionality and

many operating modes. Traditionally, discharge current is measured by calculating the expected current consumption, when the telephone is in different operating modes. Earlier mobile telephones basically had two operating modes only,: talk mode and standby mode. For such mobile telephones, the current consumption in talk mode and standby mode, respectively, was measured once in a test laboratory environment and stored in memory in the telephone as a respective predetermined consumption value. In operation, the telephone would keep track of the time spent in talk mode and in standby mode, respectively, and subsequently calculate the total amount of current consumed from the battery by multiplying the respective operational times with the predetermined consumption values.

Please amend the paragraph at page 3, line 10 as follows:

Although providing an acceptable charge consumption estimation for a simplified scenario with only two operating modes, the ~~prior art~~ approach described above has not proven applicable to more advanced telephones having a plurality of operational modes. For instance, the charge consumption of a contemporary TDMA ("Time Division Multiple Access") telephone does not only depend ~~of~~ <u>on</u> whether the telephone is in standby mode or talk mode; the charge consumption is affected by at least the following conditions in standby mode and talk mode, respectively:

Please amend the paragraph at page 4, line 4 as follows:

Of the above, the output power in talk mode has a major influence on the battery charge consumption. For a telephone which operates in more than one frequency band, i.e. a multi-band telephone, the output power is different for different frequency bands. ~~Conclusively, in~~ <u>In</u> view of ~~all the~~ <u>these</u> other parameters, which will affect the charge consumption, a multi-band telephone will have a very large number of different operating modes. Previous~~ly known~~ approaches fail to provide accurate and still efficient charge

B7 consumption determination, and consequently there is an urgent need for an alternative way of determining battery charge consumption for a multi-band telephone.

Please amend the paragraph at page 4, line 17 as follows:

Summary ~~of the Invention~~

B8 The ~~object of the~~ present invention ~~is to~~ provide<u>s</u> a new and substantially improved way of determining battery charge consumption for a portable multi-band communication device, such as a mobile telephone.

Please amend the paragraph at page 4, line 22 as follows:

B9 ~~Generally, the object has been achieved by the following inventive understandings. Firstly, the aforesaid~~ <u>The</u> problem that a multi-band communication device inherently has a very large number of different operating modes, thereby making conventional charge consumption estimation both complex and inaccurate, can be avoided by making use of an already existing power amplifier control facility. More specifically, whenever voice or data is to be transmitted from a multi-band telephone, the transmission has <u>to</u> be carried out at correct output power level, which - as described above - depends on the frequency band used. Correct output power is obtained by ~~the~~ <u>a</u> controller by regulating an analog control signal to the power amplifier module. To this end, the controller calculates a proper digital (e.g. hexadecimal) value (DAC value), which is converted by a D/A (digital-to-analog) converter into the analog control signal to the power amplifier.

Please amend the paragraph at page 5, line 4 as follows:

B10 ~~Now, according to the invention, since~~ <u>Since</u> the power amplifier consumes a major part of the total current drawn from the battery in talk mode, the charge consumption of the power amplifier may be accurately predetermined for different DAC values, preferably by way of measurements in a test laboratory environment, before the

B10

telephone is initially ~~being~~ used. ~~Consequently, these~~ These predetermined charge consumption values ~~will be~~ are associated with a respective ~~one of all possible~~ DAC values and ~~will be~~ prestored in a memory of the telephone.

Please amend the paragraph at page 5, line 14 as follows:

B11

~~Furthermore, according to the invention, these~~ These prestored charge consumption values are used by the controller for keeping a record of an accumulated charge consumption value between subsequent battery chargings. This is possible~~,~~ since the controller is also responsible for generating the DAC values whenever a transmission is to take place. Therefore, the controller will always have access to the momentary DAC value and may read a corresponding prestored charge consumption value to be added to the accumulated value.

Please amend the paragraph at page 5, line 24 as follows:

B12

The invention is particularly well adapted for telephones, like a TDMA telephone, which uses different control pulses or "strobes" for switching on and off different radio circuits, e.g. power amplifier, filters and synthesizer, as well as other electronic circuits, e.g. A/D converters. In a TDMA phone, the ~~The~~ strobes are all completely controlled by the microprocessor in such a way~~,~~ that the telephone may send and receive in the correct timeslot.

Please amend the paragraph at pages 5 and 6, line 32 as follows:

B13

~~More specifically, the object above has been achieved by a portable communication device and a method of determining the charge consumption thereof according to the appended independent patent claims.~~ Other objects, features, and advantages of the present invention will appear from the following detailed disclosure, from the attached drawings as well as from the dependent claims.

Please amend the paragraph at page 5, line 24 as follows:

Detailed Disclosure of <u>Example, Non-Limiting</u> Embodiments

Some <u>example, non-limiting</u> embodiments of the present invention will now be described in detail by referring to a <u>an example</u> mobile telephone 1 shown in FIG 1. However, as already mentioned, the present invention is equally applicable to all other portable communication devices, which fall under the definitions in the independent claims.

Please amend the paragraph at page 5, line 31 as follows:

The mobile telephone 1 <u>in this example</u> is a cellular GSM TDMA telephone and comprises an antenna 2, a top indicator 3 for indicating operational status, a speaker 4, volume adjustment buttons 5, a graphical display 6, a set of keys in a keypad 7 and a flip 8, which is pivotally mounted to a telephone housing 11 by means of a hinge 12. The flip 8 has a speech opening 9 for receiving vocal acoustic energy from the user of the telephone. The acoustic energy is transmitted through the flip 8, via an internal sound guiding channel not shown in the drawing, to an internal microphone (not shown) in the telephone housing 11.

Please amend the paragraph at page 10, line 3 as follows:

As already mentioned, a TDMA telephone uses a number of control pulses or strobes, which are used to switch on and off i.a. various radio circuits. The strobes are all completely controlled by the CPU 242 in such a way, that the telephone is capable of sending and receiving in the correct TDMA timeslot. For instance, the TX strobe is activated at least once for each TDMA frame in order to switch on transmitter 214 and the components associated therewith, such as the power amplifier 216. The transmitter is activated, by the TX strobe, just before the correct timeslot and is then deactivated immediately after this timeslot, by switching the TX strobe from e.g. a high logical value to a low logical value. In normal talk mode, i.e. for a voice call, the TX strobe is

generated ~~exactly~~ once in every TDMA frame by the CPU 242 and the timing generator 246, for as long as the ongoing telephone call lasts. In case of a data call, on the other hand, the number of TX strobes may be two or more (multislot) in each TDMA frame. Simultaneously, as described above, the CPU 242 determines a certain digital (hexadecimal) value of the digital control signal DAC value, which is converted into the analog control signal Pwr Ctrl used for regulating the power amplifier 216 in order to obtain a correct output power level of the transmitter 214.

Please amend the paragraph at page 10, line 27 as follows:

Now, since the TX strobe activates/deactivates a well-defined set of electronic circuits in the transmitter 214 and the power amplifier 216, and since the individual charge consumption of each of these circuits is well-known and/or may be accurately measured ~~once and for all,~~ with respect to all possible DAC values, in a test laboratory environment, the different DAC values are associated, ~~according to the invention,~~ with respective predetermined specific current consumption values, representing the current consumed by all relevant transmitter and power amplifier circuits upon activation by one TX strobe.

Please amend the paragraph at page 11, line 3 as follows:

~~Consequently, by~~ By keeping track of the number of times that the TX strobe has occurred for different DAC values, the total current consumption, caused by TX strobes during a given period of time, may easily be calculated by multiplying the results of the count with the predetermined current consumption values per TX strobe.

Please amend the paragraph at page 11, line 10 as follows:

As an important advantage, the inventive scheme described above ~~will be completely~~ works independent of whether the telephone has been used for a voice call (involving exactly one TX strobe per TDMA frame) or a data call (multislot, possibly

involving more than one TX strobe per TDMA frame). The detector 247 ~~will~~ simply keeps track of all TX strobes, irrespective of in what frames they may appear.

Please amend the paragraph at page 11, line 18 as follows:

In addition to the above, ~~also~~ the RX strobe and other strobes may also be monitored, such as an A/D strobe for controlling the A/D converter 248.

Please amend the paragraph at page 13, line 14 as follows:

A second example embodiment is illustrated in FIGs 6-8. As shown in FIG 6, the second example embodiment uses a single counter only (Current Count) instead of a table of counters, thereby saving memory. A current consumption register 610, holding predetermined current consumption values, is still used.

Please amend the paragraph at page 13, line 20 as follows:

An algorithm for real-time monitoring of TX strobes according to the second example embodiment is shown in FIG 7. The current counter is reset or initialized in step 700. In a step 710, it is monitored whether a TX strobe has been detected. If the answer is in the affirmative, the control is transferred to step 720, where the momentary DAC value is determined. In step 730 the current counter is incremented by the contents of the memory cell TxCurrent[DAC value] of current consumption register 610, in accordance with the momentary DAC value determined in step 720. On completion of step 730, the control is transferred back to the beginning of step 710.

Please amend the paragraph at page 13, line 32 as follows:

FIG 8 illustrates an algorithm for updating the battery indicator according to the second example embodiment. In step 800, an accumulated charge consumption value is simply calculated by multiplying the transmit burst duration $t_{TxStrobe}$ with the value of the current counter. In subsequent steps 810 and 820, the remaining battery charge is

determined, and the battery icon 13 is updated on the display 6, in similarity with steps 510 and 520 of FIG 5. Compared to the first embodiment, the second embodiment represented by FIGs 6-8 is more memory-efficient and also avoids multiplication by complete registers, thereby saving CPU power efficiency.

Please amend the paragraph at page 14, line 9 as follows:

A third example embodiment of the invention is shown in FIGs 9-11. For the third embodiment, the memory efficiency has been further improved. The size of the current consumption register 910 has been reduced as compared to the first and second embodiments. This will cause essentially no, or at least very little, loss in accuracy by using interpolation to obtain a correct current consumption value. In similarity with the second embodiment, the third embodiment uses one single current counter, but the current consumption register 910 has been reduced in size by only storing a current consumption value for every eighth DAC value. The current consumption register 910 is indexed by calculating idx-DAC value modulus 8. Two adjacent memory cells TxCurrent[idx] and TxCurrent[idx+1] are read, and these values are used for interpolating a correct current consumption value, as shown in the flow chart of FIG 10.

Please amend the paragraph at page 15, line 3 as follows:

According to yet another example embodiment, the current consumption registers of the first, second, and third example embodiments may be replaced by a polynomial, which describes current consumption as a function of DAC value, for further improved memory efficiency.

Please amend the paragraph at page 15, line 34 as follows:

The invention has been described above with reference to a few example embodiments. However, the present invention shall in no way be limited by the description above; the scope of the invention is best defined by the appended independent

claims. Other embodiments than the particular ones described above are equally possible within the scope of the invention. For instance, even if according to the above embodiments the determination of the total charge consumption is determined in both hardware (strobe detector 247) and software (routine executed by the CPU 242), the scheme may be implemented solely in hardware, solely in software or partly in software and partly in hardware. Moreover, the invention is applicable also to other telephones than TDMA telephones, such as W-CDMA telephones.